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Interaction Triangle of Mobile Learning & E-Learning and Computer Tools (CUAELML) in the Basic Class: Attitudes & Opinions of Pre-Service Teachers

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Abstract

Computers, m-learning and e-learning which are the most significant tools of information age, have increasingly been used in each stage of education system. The participants were two hundreds and fifteen (215) pre-service teachers who have participated in this study. Specific influences between m-learning, e-learning and computer tools are presented. The implications for CUAELML and suggestions for pre-service teachers' opinions and attitudes are discussed. According to analysis results, the attitude of the pre-service teachers regarding e-learning has the higher positive effect on m-learning rather than computer usage. A model, which explained the effect of attitudes of electronic learning (AEL), mobile learning (ML) and computer usage (CU) on learning, was established and tested. Using AMOS 18 (Analysis of Moment Structures) program, it explained 50% of CU TOOLS, 64% of ML TECHNOLOGY and 67% of AEL, with good model fit.

Keywords

E-Learning, Attitude; Pre-service Teachers; Mobile Learning; Computer Usage

Introduction

Computers and mobiles are available in Yemen Country as personal purposes. There are many people who have limited experience in using computer in comparison to mobile usage. Most of them use mobile devices for daily contact. Some of them have an idea to use computers and mobiles for changing universities and schools environment, particularly in terms of teaching and research. To reach this, the education content, education methods, teaching objectives, schools and universities infrastructure, teachers' skills, learning style, pedagogical staff, technological background… should be changed. Therefore, it is important to study the pre-service teachers' attitudes and opinions towards e-learning, m-learning and computer usage as the modern technology that may be used to develop learning style in Yemen and reform the teaching methods.

However, development of information technology (IT) has increased educational opportunities and opened the doors to new instructional methods. Nowadays, educators and students have adopted technology as a normal part of their curriculum. The introduction of web based student learning systems has been adopted by many schools to overcome many of the limitations of the typical teacher centric educational model. It also allows providing learning environments that improve contact and increase student interaction (Zahra Taleb, Amir Sohrabi, 2012).

Pemberton, et al. (2006) conducted a study on using interactive computer technology to enhance learning and found that the use of ICT creates a powerful learning environment and intrinsically motivate students to learn and participate in classroom activities. Computer technology is an important tool to support new ways of teaching and learning. It can be used to develop students' skills for cooperation, communication, problem solving and lifelong learning (Voogt, 2008).

Therefore, with new technology the education become more flexible and can be reached from different channels anywhere and anytime. One of these new technologies is a mobile device which becomes one of the educational means so that the mobile technologies can be used with different manners in education (Jin, 2009). Most benefits of mobile technologies to learning environment have pointed out such as portability, simplicity and availability (Khaddage and Lattemann, 2013). In the same time, m-technologies request highly portable, individual, unobtrusive, available, adaptable, persistent, useful, user-friendly (Sharples, 2000) which can be seen as the supporting factor of learning.

There is a solution need to provide continuity of learning in courses (Tan-Hsu Tan, 2004). After face to face courses communication about courses should be improved. Short questions, reminders, course summary or briefs helps students not to forget course key point (Li He, 2009). However, teachers and students can access various types and a large number of multimedia learning materials using their mobile devices Adkins, S. S. (2011). According to trial research in the m-learning project, teachers and students shall be attracted by mobile learning materials and shall remain motivated for continued learning (Attewell, J., 2005).

University students are using their mobile phones for communicating by voice, text, and, increasingly, digital photographs and videos. They are also now using them for wireless computing and posting to wikis and blogs functioning based on the paradigm of "anytime, anywhere" (Norris & et al. 2010). M-learning is enabled by integrating various hardware and software technologies into multimedia applications facilitating the communication of educational content in a number of different formats for university students (Moreno & Fernandez; 2008).

A majority of university students around the world carry these miniature computing and communication devices during the university day, using them almost exclusively for personal purposes (Evans, 2008). "Mobile phones are not just communication devices sparking new modalities of interaction between students; they are also particularly useful computers that fit in their pockets, are always with them, and are nearly always on (Prenski, 2005). They present a real opportunity to integrate the learning process with 'real life' activities. Mobile phones give student in the university (SU) the opportunity to carry their learning in their hand.

Mobile devices are cheaper than a personal computer and are used by many because the devices are more affordable and in the case of mobile phones, is almost a necessity to have. Based on reviews of m-learning, it can be concluded that M-learning can significantly complement e-learning by creating an additional channel of access for users of mobile devices such as hand phones, PDAs, MP3 and MP4 players (Goh & Kinshuk, 2006). M-learning allows learners to access computer-based learning anytime, anywhere. It overcomes poor Internet connectivity, frequent power disruptions and low PC support and availability, especially in remote and rural areas (Traxler, 2007). Cook et al (2007) suggested that 'learner-generated contexts' in mobile learning provides a more generic description of the value of digital technologies than the more common idea of 'user-generated content' in social software.

The suggested key difference is digital representation of physical objects that are in the same location as the learner (Price, 2007). Mansori et al (2010) showed that students have positive view and interest regarding m-learning. They were familiar with barriers of m-learning and believe that it could be advantageous for their learning processes.

However, the evaluation of mobile learning systems can be implemented in various stages of development. T. Magal-Royo, et al. (2007) marked milestones in the development of mobile learning systems, types of evaluation that can be used and the results which can be obtained as a result of that assessment. Most often for the evaluation of the systems for mobile learning specially designed questionnaires are used. In those questionnaires most commonly the Likert 5-point scale format Pei-Ping Luo, et al. (2010), Dan Corlett, et al. (2005), Jie-Chi Yang and Kun-Huang Chien (2008), and Luvai Motiwalla (2007) is implemented, but in some studies 4-point scale Satoko Amemiya, et al. (2007) is used.

In some studies Debra Nestel (2010) are used questionnaires and interviews with the users.

Computers, m-learning and e-learning which are the most significant tools of information age, have increasingly been used in each stage of education system.

Objectives

- To analyse the effectiveness of mobile learning (ML) on the computer usage regarding the pre-service teachers' opinions of basic class.
- To investigate the pre-service teachers' attitude of e-learning (AEL) on computer usage (CU).
- To study the influences of pre-service teachers' attitude of e-learning (AEL) on mobile learning (ML).

Methodology

The method adopted for the present study was descriptive and statistical in nature. It provides a flexible framework for selecting materials and participants, defining criteria and measures, and implementing evaluation techniques. By adapting these different techniques, the proposed structure model for CUAELML aims to assess the effect of mobile learning (ML) on computer usage (CU) and the effect of pre-service teachers' attitude of e-learning (AEL) on computer usage (CU) and ML.

Different statistical techniques were used including instrument development, a confirmatory factor analysis (CFA), an exploratory analysis (Mean (M), Standard Deviation (SD), Principal Component Factor and Cronbach's alpha, (exploratory factor analysis (EFA) is used to determine how many latent variables should be used)), Construct Reliability, and a test of a structural model. Convergent validity and Discriminant validity were used in this research according to the recommendations of Fornell and Larcker (1981a) and Koufteros et al. (2001).

There are twenty-four observed (endogenous) variables, which are CU1 … CU8, ML1 … ML8 and AEL1 … AEL8 and there are three unobserved (exogenous) variables, which are CU, ML and AEL respectively.

To assess the fit of the model to the data, Chi-square per degrees of freedom, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), confirmatory factor analysis (CFI), root mean residual (RMSR), the root mean square error of approximation (RMSEA), and modification index (MI) were computed. If the model fits the data adequately, the t-values of the structural coefficients will be evaluated to test the research hypotheses. Figure 1 illustrates proposed CUAELML Model below.

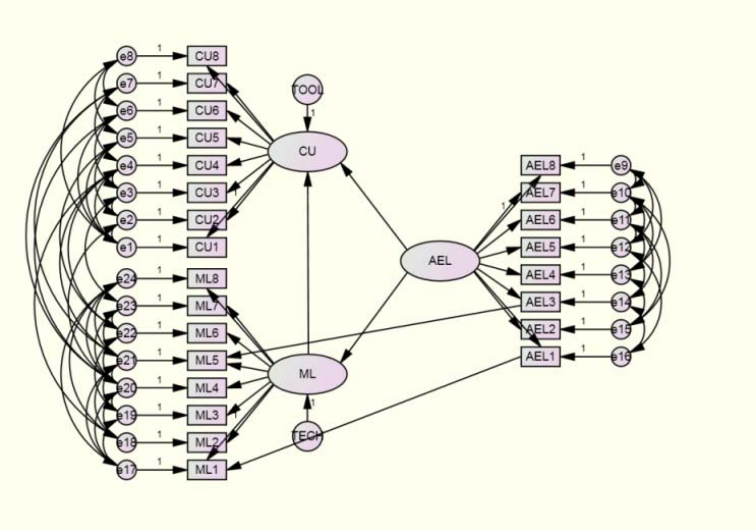

FIG. 1 CUAELML Model

Population and Sample:

The difficulty of studying the whole population enforces the researchers to randomly choose a sample of 215 of pre-service teachers in the category of the basic class. Out of which 80 were of Basic English Language, 53 were of Basic Mathematics, 42 were of Basic Biology and 39 were of Basic Science of Quran. All of them had enough knowledge of computer and mobile devices and searched information using different engines (Google and Yahoo search engines) before this study. Therefore, the total of usable responses was 215 which means there were not missing responses and whole the questionnaire for 215 participants was completed successfully.

Descriptions of the Tool used and Construct Measures:

In this study, the data were collected via a questionnaire survey of Likert 5-point scale format (1= strongly disagree, 2= disagree, 3= neutral, 4= agree and 5= strongly agree). The design of the questionnaire follows the stages outlined by A. Albirini (2006) in the case of computer. Content validity was ensured through a comprehensive review of the literature and interviews with practitioners, i.e., the indicators in the questionnaire were based on previous studies (A. Albirini (2006); Tan-Hsu Tan, 2004; Li He, 2009; Norris & et al. 2010; Prenski, 2005; Goh & Kinshuk, 2006; Traxler, 2007; and Price, 2007) interviews and discussions with practitioners and a number of experts in mobile learning and e-learning.

The items in the questionnaire were judged as relevant by 8 indicators for each of CU, ML and AEL factors. Therefore, the total of observed variables is 24. The interviews resulted in minor modifications to some words provided in some measurement items, which were finally accepted as possessing content validity. The refined measurement items were included in the final survey questionnaire administered to the target respondents.

Data Collection:

Collection of data is an important phase in any research work. Various difficulties are generally felt by the investigators whole collecting data. In the present study, the data was to be collected from four departments of basic class final year in Taiz University (TU) – Yemen Country.

Before approaching the subjects in various departments, the researchers first took permission from the chairmen of the respective departments for survey.

In order to collect the systematic data, it was essential to approach subjects and the investigators did the same. After contacting participants, the investigators explained the objectives of the study to them. The respondents were assured that the information provided by them would be kept strictly confidential.

The questionnaire was used for CUAELML and included three parts (for CU, ML and AEL) tests, which consisted of total twenty-four questions.

Then the investigators distributed the questionnaire among the participants. They were asked to go through the general instructions given on the top of them before filling the given entries. Lastly, the participants were asked to read the statements carefully and requested to give their responses to every statements. Doubts and confusions were clear by the investigators as per the requirements of the participants.

The investigators also gave full freedom to the participants to ask the meaning of the words or sentences which were beyond their understanding. Moreover, there was not any kind of undue stress and control over the participants at the time of completion of the CUAELML. After completion, it was collected from the participants and checked by the investigators whether the participants filled all the entries.

Statistical Techniques Used:

The analysis of data was done by using statistical techniques, which were chosen only after the investigators found them to be most appropriate and compatible for the collected data. This analysis was depended on the previous studies of Gamal A. A. Alawi and Nakhat Nasreen (2013), of Koufteros (1999) and Koufteros et al. (2001). These statistical techniques were included instrument development, a confirmatory factor analysis (CFA), an exploratory analysis (Mean (M), Standard Deviation (SD), Principal Component Factor and Cronbach's alpha, (exploratory factor analysis (EFA) is used to determine how many latent variables should be used)), Construct Reliability, and a test of a structural model.

However, convergent validity was assessed by examining the significance of individual item loadings through t-tests. The overall fit of a hypothesized model can be tested by using the maximum likelihood Chi-square statistic provided in the Amos (a software package for SEM) output and other fit indices such as the ratio of Chi-square to degrees of freedom, goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), root mean residual (RMR), the root mean square error of approximation (RMSEA), and The Tucker Lewis Index (TLI). Discriminant validity was assessed by comparing the average variance extracted (AVE) to the squared correlation between constructs.

The AVE estimate is a complimentary measure to the measure of composite reliability (Fornell and Larcker, 1981a; Koufteros et al., 2001).

Research Hypotheses:

Based on the research framework (see figure1), the CUAELML model originally defined computer usage (CU), mobile learning (ML) and pre-service teachers' attitude of e-learning (AEL) as three main factors. Each factor consisted of eight observed variables

Many studies concentrated on efficiency, influences, ability, and achievement of using interactive computer technology, mobile technologies, m-learning regarding computer-based learning, and e-learning to improve learning outcomes (Zahra Taleb, Amir Sohrabi, 2012; Pemberton, Borrego and Cohen, 2006; Voogt, 2008; Jin, 2009; Khaddage and Lattemann, 2013; Tan-Hsu Tan, 2004; Li He, 2009; Norris & et al. 2010; Prenski, 2005; Goh & Kinshuk, 2006; Traxler, 2007; and Price, 2007).

It is therefore reasonable to expect that ML may have a positive effect on a computer usage (CU) and Pre-service teachers' attitude of e-learning (AEL) may have a positive effect on a computer usage (CU) and ML. Thus, the researchers hypothesize that:

H1: Mobile learning (ML) has a positive effect on a computer usage (CU).

H2: Pre-service teachers' attitude of e-learning (AEL) has a positive effect on a computer usage (CU).

H3: Pre-service teachers' attitude of e-learning (AEL) has a positive effect on a mobile learning (ML).

Instruments:

As mentioned above the questionnaire was composed of 24 questions concerning the CUAELML (Cronbach's Alpha α=.802).

Analysis and Results

Coefficient Alpha and Reliability:

Cronbach's alpha is used for evaluating reliability (Koufteros, 1999). The Cronbach's alpha value for each measure is shown in Table 1. The reliability value for each construct was well above the value of 0.7, which is considered satisfactory for basic research (Nunnally, 1978; Churchill, 1991; Litwin, 1995). Nevertheless, Cronbach's alpha has several disadvantages, one of them that Cronbach's alpha cannot be used to infer unidimensionality (Gerbing and Anderson, 1988).

TABLE 1. CRONBACH ALPHA VALUES FOR EACH FACTOR

Measures	Cronbach alpha
Factor 1: Attitudes of e-learning	0. 754
(AEL1, AEL2, AEL3, AEL4, AEL5, AEL6, AEL7, AEL8)	
Factor 2: Mobile learning	0.752
(ML1, ML2, ML3, ML4, ML5, ML6, ML7, ML8)	
Factor 3: Computer usage	0.762
(CU1, CU2, CU3, CU4, CU5, CU6, CU7, CU8)	

Construct Reliability and Variance Extracted Measures:

The reliability and variance extracted measures for each construct are needed to assess whether the specified items represent the constructs, sufficiently. The reliability of a construct can be estimated using AMOS 18 output.

Construct reliability means that a set of latent indicators of constructs are consistent in their measurement. In more formal terms, this reliability is the degree to which a set of two or more indicators share the measurement of a construct. Highly reliable constructs are those in which the indicators are highly inter-correlated, indicating that they are all measuring the same latent construct. The range of values for reliability is between 0 and 1. Computations for each construct are shown in Table 2.

The reliability of the constructs of pre-service teachers' attitude of e-learning, computer usage, and mobile learning were 0.886, 0.888, and 0.889, respectively. All constructs exceeded the recommended level of 0.70 (Hair et al., 1998).

TABLE 2. DESCRIPTIVE STATISTICS AND CONSTRUCT RELIABILITY FOR EACH CONSTRUCT

Measures	Mean[a]	S.D.[b]	Construct reliability[c]
AEL	31.7903	4.50343	0.886
(AEL1, AEL2, AEL3, AEL4, AEL5, AEL6, AEL7, AEL8)			
ML	26.6371	4.17763	0.889
(ML1, ML2, ML3, ML4, ML5, ML6 ML7, ML8)			
CU	31.9919	4.47667	0.888
(CU1, CU2, CU3, CU4, CU5, CU6, CU7, CU8)			

a The mean scores of attitude of e-learning, mobile learning and computer usage
b SD = standard deviation.
c Construct reliability = (sum of standardized loadings)2/[(sum of standardized loadings)2 + (sum of indicator measurement error)].

Results of Hypothesis Testing:

The model's overall fit with the data was evaluated using common model goodness-of-fit measures estimated by AMOS 18 (Analysis of Moment Structures) program; it explained 50% of CU TOOLS, 64% of ML TECHNOLOGY and 67% of AEL, with good model fit see figure2 bellow. Overall, this model exhibited a reasonable fit with the data collected.

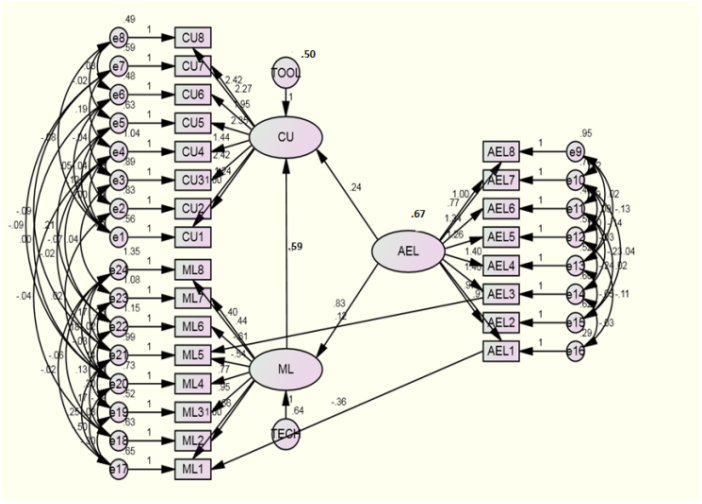

FIG. 2 CUAELML UNSTANDARDIZED MODEL

Based on the data, the AMOS estimation of this model showed a value of 1.087 in the Chi-square to degree of freedom ratio, which is satisfactory with respect to the commonly recommended value of less than 2.0. We assessed the model fit using other common fit indices: goodness-of-fit index (GFI), adjusted goodness-of-fit index (AGFI), comparative fit index (CFI), root mean square residual (RMSR), root mean square error of approximation (RMSEA), standardized residual, and modification index (MI). The model exhibited a fit value exceeding or close to the commonly recommended threshold for the respective indices, e.g., values of GFI=0.941, AGFI=0.851, RMR=0.075, CFI=0.979, TLI=0.972, RMESA=0.027, satisfactory with respect to the commonly recommended values.

The hypotheses also were tested as shown in Figure3. . As summarized in Table3, the specified relationship between pre-service teachers' attitude of e-learning and mobile learning was supported by the data, as indicated by a significant critical ratio (C.R. = 2.927). The C.R. is a t-value obtained by dividing the estimate of the covariance by its standard error. A value exceeding 1.96 represents a level of significance of 0.05. Therefore, pre-service teachers' attitude of e-learning has positive effect on mobile learning (H3).

This reflects that attitude towards e-learning was the most important determinant of CUAELML throughout this research. Pre-service teachers' attitude of e-learning (AEL) has a positive effect on a computer usage (CU) (C.R. = 2.023 (H2)). In addition, it found that the effect of Mobile learning (ML) on the computer usage (CU) was significant (C.R. = 2.007 (H1)).

In sum, the tests of the structural model showed that the three hypotheses were fulfil in this research as shown in the table3 below.

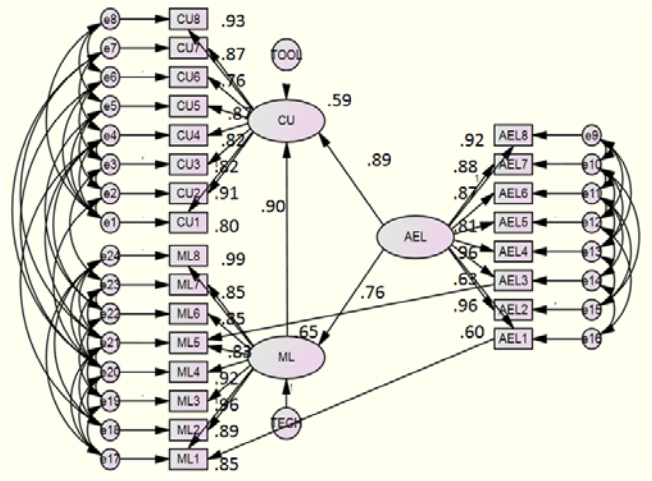

FIG. 3 CUAELML STANDARDIZED MODEL

TABLE 3. RESULT OF THE STRUCTURAL EQUATION MODELLING

Variables			Estimatec	S.E.a	C.R.b
ML	<---	AEL	.834	.285	2.927
CU	<---	AEL	.239	.118	2.023
CU	<---	ML	.083	.057	2.007

Fit indices Chi-square (v2 =230.368), p=0.184, df=212, v2 / df=1.087
GFI=0.941, AGFI=0.851, RMR=0.075, CFI=0.979, TLI=0.972, RMESA=0.027

a S.E. is an estimate of the standard error of the covariance.
b C.R. is the critical ratio obtained by dividing the covariance estimate by its standard error.
c Values are critical ratios exceeding 1.96, at the 0.05 level of significance.

Calculated Variance Extracted (AVE):

Evidence of discriminant validity is provided by the AVE method. The AVE for the latent variables via CU, AEL and ML was 0.847875, 0.831875 and 0.893, respectively. The results have demonstrated evidence of discriminant validity for the study constructs.

Discussion and Conclusion

Computers, m-learning and e-learning which are the most significant tools of information age, have increasingly been used in each stage of education system (Voogt, 2008; Jin, 2009; T. Magal-Royo, et al., 2007).

For this reason, this study flows the framework of (Gamal A. A. Alawi and Nakhat Nasreen (2013); A. Albirini (2006); Tan-Hsu Tan, 2004; Li He, 2009; Norris & et al. 2010; Prenski, 2005; Goh & Kinshuk, 2006; Traxler, 2007; and Price, 2007).

Therefore, it was conducted for testing the pre-service teachers' attitudes and opinions towards e-learning, m-learning and computer usage as the modern technology that may be used to develop learning style in Yemen and reform the teaching methods.

It has investigated the underlying relationships between e-learning, computer and mobile learning which support online teaching for basic class.

All hypotheses postulated by the structural model are supported. As a result, the m-learning with e-learning has a strong positive effect on the learning of basic class according to the opinions of pre-service teachers. This result supported the Goh & Kinshuk (2006) claimed that described the relationship between e-learning and m-learning as the complement factors for distributing learning for both teachers and students. It is also similar with the result of Mansori et al (2010) in the category of m-learning.

Having its stronger impact on reading, listening, and watching activities, it is emphasized that e-learning is required in basic class particularly for receiving knowledge through multimedia anywhere and anytime in academics and research.

Receiving knowledge through multimedia learning using e-learning tools was compliant with the Adkins, S. S. (2011) claimed and the results supported by the suggestion of *Cook et al (2007)*.

Using the Internet connection of many Journals and Magazines encourages teachers of basic class and researchers to interact with m-learning, computer and e-learning.

In addition, researchers may build on this model to identify and examine other factors that may influence learning to use mobile learning and e-learning such as the Internet skills, abilities and skills of using computer in education, including the level of information technology in the organizations and computer resources. The integration of these constructs into the model will help researchers to further grasp the factors influencing the development of electronic learning in the schools and universities (Khaddage and Lattemann, 2013;).

Therefore, it is significant that media as a technique or a tool of the e-learning and m-learning should be more widespread, and faculty members in higher education and basic class teachers should be supported with technical and technological equipments and the process should be institutionalized via the policies and strategies of schools and universities.

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APPENDIX

TABLE 4: ATTITUDES OF E-LEARNING

No.		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	e-learning helps me to know which learning style I am interested in	1	2	3	4	5
2	e-learning helps me to make learning assumptions	1	2	3	4	5
3	e-learning helps me to determine the suitable learning area	1	2	3	4	5
4	e-learning helps me to determine the suitable time for learning	1	2	3	4	5
5	e-learning helps me to determine my learning requirements	1	2	3	4	5
6	e-learning provides logical series of curriculum	1	2	3	4	5
7	e-learning provides suitable learning activities	1	2	3	4	5
8	e-learning provides independent learning	1	2	3	4	5

TABLE 5: COMPUTER USAGE (CU)

No.		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	The computer could be used to provide several learning information.	**1**	**2**	**3**	**4**	**5**
2	The computer could be used to evaluate learners' performance	**1**	**2**	**3**	**4**	**5**
3	Some roles of the educators could be introduced by the computer	**1**	**2**	**3**	**4**	**5**
4	The computer could be used to give learning feedback immediately	**1**	**2**	**3**	**4**	**5**
5	The computer could be contributed to increase learners' thinking styles	**1**	**2**	**3**	**4**	**5**
6	The computer could be used to contribute learners' learning motivate	**1**	**2**	**3**	**4**	**5**
7	The computer could be used to increase some learners' skills	**1**	**2**	**3**	**4**	**5**
8	The computer could be used to increase positive self-learning	**1**	**2**	**3**	**4**	**5**

TABLE 6: MOBILE LEARNING (ML)

No.		Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1	I always download some educational videos in my mobile	1	2	3	4	5
2	The mobile helps me to improve my learning skills.	1	2	3	4	5
3	I prefer to learn using a mobile device	1	2	3	4	5
4	The mobile helps me to find information immediately	1	2	3	4	5
5	I am not comfortable when using a mobile as the learning tools.	1	2	3	4	5
6	I prefer the traditional learning style than using the mobile methods.	1	2	3	4	5
7	Learning using the mobile device is suitable for developing learning communication skills.	1	2	3	4	5
8	I prefer to know more about using a mobile in learning and teaching.	1	2	3	4	5